

AMENDMENTS TO THE CLAIMS:

Claims 1-32 (cancelled)

33. (Currently amended) The component recognizing method according to claim ~~32~~ 45, wherein when bottom end surfaces of said plurality of component holding members are at identical levels said surfaces of said plurality of components are incapable of all being within said recognizable range simultaneously, said method further comprising:

acquiring information on groups of said plurality of component holding members that hold respective ones of said plurality of components having surfaces which are capable of being received within said recognizable range simultaneously,

wherein transversely moving said plurality of component holding members relative to said recognition unit comprises

(i) moving said plurality of component holding members in a first direction over said recognition unit such that a corresponding surface of each of said plurality of components held by said component holding members of one of said groups is within said recognizable range without first vertically moving a corresponding one of said plurality of component holding members, and

(ii) moving said plurality of component holding members in a second direction, opposite to said first direction, over said recognition unit such that a corresponding surface of each of said plurality of components held by said component holding members of a second of said groups is within said recognizable range after first vertically moving of a corresponding one of said plurality of component holding members.

Claims 34-36 (cancelled)

37. (Currently amended) The component recognizing apparatus according to claim ~~36~~ 48, wherein when bottom end surfaces of said plurality of component holding members are at identical levels the surfaces of the plurality of components are incapable of all being within the recognizable range simultaneously, said apparatus further comprising:

structure for acquiring information on groups of said plurality of component holding members that hold respective ones of the plurality of components having surfaces which are capable of being received within the recognizable range simultaneously,

wherein said recognition unit, said plurality of component holding members and said drive unit are constructed and arranged such that transversely moving said plurality of component holding members relative to said recognition unit comprises

(i) moving said plurality of component holding members in a first direction over said recognition unit such that a corresponding surface of each of the plurality of components held by said holding members of one of said groups is within the recognizable range without first vertically moving a corresponding one of said plurality of component holding members, and

(ii) moving said plurality of component holding members in a second direction, opposite to said first direction, over said recognition unit such that a corresponding surface of each of the plurality of components held by said holding members of a second of said groups is within the recognizable range after first using said drive unit to vertically move a corresponding one of said plurality of component holding members.

Claims 38-40 (cancelled)

41. (Currently amended) The component mounting apparatus according to claim ~~40~~ 51, wherein when bottom end surfaces of said plurality of component holding members are at identical levels the surfaces of the plurality of components are incapable of all being within the recognizable range simultaneously, said apparatus further comprising:

structure for acquiring information on groups of said plurality of component holding members that hold respective ones of the plurality of components having surfaces which are capable of being received within the recognizable range simultaneously,

wherein said recognition unit, said plurality of component holding members, said drive unit and said head unit are constructed and arranged such that transversely moving said plurality of component holding members relative to said recognition unit comprises

(i) moving said plurality of component holding members in a first direction over said recognition unit such that a corresponding surface of each of the plurality of components held by said component holding members of one of said groups is within the recognizable range without first vertically moving a corresponding one of said plurality of component holding members, and

(ii) moving said plurality of component holding members in a second direction, opposite to said first direction, over said recognition unit such that a corresponding surface of each of the plurality of components held by said component holding members of a second of said groups is within the recognizable range after first using said drive unit to vertically move a corresponding one of said plurality of component holding members.

42. (Currently amended) A component mounting apparatus comprising:

a first group and a second group of component holding members;

a table having cylinders fixed thereto, said cylinders corresponding to said component holding members;

a drive unit to vertically move said table such that each of said cylinders is capable of bringing a tip of a piston into contact with a selected corresponding one of said component holding members so as to vertically move the selected corresponding one of said component holding members, from among the other of said component holding members first group and said second group of component holding members;

a recognition unit;

a head unit including said ~~plurality of~~ component holding members and said drive unit; and

structure for acquiring information on said first group and said second group of component holding members, wherein each component holding member of said first group is to hold a component such that a surface of this component is within a recognizable range of said recognition unit when a bottom end surface of said each component holding member of said first group is at a first level, and wherein each component holding member of said second group is to hold a component such that a surface of this component is not within the recognizable range of said recognition unit when a bottom end surface of said each component holding member of said second group is at the first level,

wherein said table, said first and second groups of component holding members, said drive unit, said recognition unit and said head unit are constructed and arranged such that

(i) while moving said each component holding member of said first group in a first direction over said recognition unit such that said bottom end surface of said each component holding member of said first group is at the first level, the surface of each component held by said each component holding member of said first group is recognized by said recognition unit, and then

(ii) after using said drive unit to vertically move said table so as to vertically move said each component holding member of said second group such that the surface of each component held by said each component holding member of said second group is within the recognizable range of said recognition unit, and while moving said each component holding member of said second group in a second direction, opposite to the first direction, over said recognition unit, the surface of each component held by said each component holding member of said second group is recognized by said recognition unit.

43. (Previously presented) The component mounting apparatus according to claim 42, wherein said recognition unit is constructed and arranged such that

recognizing the surface of each component held by said each component holding member of said first group, by said recognition unit, includes recognizing a shape of each component held by said each component holding member of said first group, and

recognizing the surface of each component held by said each component holding member of said second group, by said recognition unit, includes recognizing a shape of each component held by said each component holding member of said second group.

Claim 44 (Cancelled)

45. (Currently amended) ~~The component recognizing method according to claim 32, further comprising:~~ A component recognizing method comprising:

while transversely moving a plurality of component holding members relative to a recognition unit, with said plurality of component holding members holding a plurality of components such that surfaces of said plurality of components are at different levels, for the surface of a selected one of said plurality of components that does not correspond to a recognizable range of said recognition unit,

(i) producing a velocity curve, for vertical movement of a ~~selected~~ corresponding one of said plurality of component holding members that is holding said selected one of said plurality of components, with parameters of

(a) a target position in a height direction at a time when vertical movement of said ~~selected~~ corresponding one of said plurality of component holding members is to be controlled so as to position the said surface of said selected one of said plurality of components ~~the component held by said selected one of said plurality of component holding members~~ within said recognizable range,

(b) a maximum velocity of said ~~selected~~ corresponding one of said plurality of component holding members during vertical movement thereof to said target position, and

(c) a maximum acceleration of said ~~selected~~ corresponding one of said plurality of component holding members during vertical movement thereof to said target position; and

(ii) on a basis of said velocity curve, and in response to a starting instruction upon arrival of said ~~selected~~ corresponding one of said plurality of component holding members at a starting position due to said ~~selected~~ corresponding one of said plurality of component holding members moving transversely toward said recognition unit, automatically starting vertical movement of said ~~selected~~ corresponding one of said plurality of component holding members so as to ~~position~~ adjust the level of said surface of said ~~component held by said~~ selected one of said plurality of ~~component holding members~~ components such that this surface is brought within said recognizable range, and

(iii) when said surface of said selected one of said plurality of components comes within said recognizable range, using said recognition unit to recognize this surface.

46. (Currently amended) The component recognizing method according to claim 45, further comprising:

producing a velocity curve, for vertical movement of each other of said plurality of component holding members, with parameters of

(i) a target position in a height direction at a time when vertical movement of said each other of said plurality of component holding members is to be controlled so as to position the surface of the component held by said each other of said plurality of component holding members within said recognizable range,

(ii) a maximum velocity of said each other of said plurality of component holding members during vertical movement thereof to said target position, and

(iii) a maximum acceleration of said each other of said plurality of component holding members during vertical movement thereof to said target position; ~~and~~

on a basis of said velocity curve for said each other of said plurality of component holding members, and in response to a starting instruction upon arrival of said each other of said plurality of component holding members at a starting position due to said each other of said plurality of component holding members moving transversely toward said recognition unit, automatically starting vertical movement of said each other of said plurality of component holding members, at different times, so as to position said surface of said component held by said each other of said plurality of component holding members within said recognizable range; and

when said surface of said component held by said each other of said plurality of component holding members comes within said recognizable range, using said recognition unit to recognize this surface, thereby continuously recognizing said surfaces of said plurality of components

47. (Currently amended) The component recognizing method according to claim 46, further comprising:

judging whether ending positions, corresponding to the starting positions for said ~~selected~~ corresponding one and said each other of said plurality of component holding members, have been reached so as to determine whether said surfaces of said components held by said ~~selected~~ corresponding one and said each other of said plurality of component holding members have been received within said recognizable range.

48. (Currently amended) ~~The component recognizing apparatus according to claim 36, further comprising:~~ A component recognizing apparatus comprising:

a recognition unit;

a plurality of transversely movable component holding members;

a drive unit for vertically moving said plurality of component holding members;

a first control unit for producing a velocity curve, for vertical movement of a selected one of said plurality of component holding members, with parameters of

(i) a target position in a height direction at a time when vertical movement of said selected one of said plurality of component holding members is to be controlled so as to position the surface of the component held by said selected one of said plurality of component holding members within the recognizable range,

(ii) a maximum velocity of said selected one of said plurality of component holding members during vertical movement thereof to the target position, and

(iii) a maximum acceleration of said selected one of said plurality of component holding members during vertical movement thereof to the target position; and

a second control unit for, on a basis of the velocity curve, and in response to a starting instruction upon arrival of said selected one of said plurality of component holding members at a starting position due to said selected one of said plurality of component holding members moving transversely toward said recognition unit, automatically starting vertical movement of said selected one of said plurality of component holding members so as to position the surface of the component held by said selected one of said plurality of component holding members within the recognizable range,

wherein said recognition unit, said plurality of component holding members, said drive unit, said first control unit and said second control unit are constructed and arranged such that while said plurality of component holding members are transversely moved relative to said recognition unit, with said plurality of component holding members holding a plurality of components such that surfaces of the plurality of components are at different levels,

(i) for the surface of the component held by said selected one of said plurality of component holding members, said selected one of said plurality of component holding members is

vertically moved by said drive unit so as to adjust the level of this surface such that this surface is brought within the recognizable range, and

(ii) when the surface of the component held by said selected one of said plurality of component holding members comes within the recognizable range, said recognition unit is used to recognize this surface.

49. (Currently amended) The component recognizing apparatus according to claim 48, wherein

said first control unit is also for producing a velocity curve, for vertical movement of each other of said plurality of component holding members, with parameters of

(i) a target position in a height direction at a time when vertical movement of said each other of said plurality of component holding members is to be controlled so as to position the surface of the component held by said each other of said plurality of component holding members within the recognizable range,

(ii) a maximum velocity of said each other of said plurality of component holding members during vertical movement thereof to the target position, and

(iii) a maximum acceleration of said each other of said plurality of component holding members during vertical movement thereof to the target position, and

said second control unit is also for, on a basis of the velocity curve for said each other of said plurality of component holding members, and in response to a starting instruction upon arrival of said each other of said plurality of component holding members at a starting position due to said each other of said plurality of component holding members moving transversely toward said recognition unit, automatically starting vertical movement of said each other of said plurality of component holding members, at different times, so as to position the surface of the component held by said each other of said plurality of component holding members within the recognizable range

such that while said plurality of component holding members are transversely moved relative to said recognition unit, with said plurality of component holding members holding the plurality of components such that surfaces of the components are at different levels.

(i) for the surface of the component held by said each other of said plurality of component holding members, said each other of said plurality of component holding members is vertically moved by said drive unit so as to adjust the level of this surface such that this surface is brought within the recognizable range, and

(ii) when the surface of the component held by said each other of said plurality of component holding members comes within the recognizable range, said recognition unit is used to recognize this surface,

so as to continuously recognize the surfaces of the plurality of components.

50. (Previously presented) The component recognizing apparatus according to claim 49, wherein

said second control unit is also for judging whether ending positions, corresponding to the starting positions for said selected one and said each other of said plurality of component holding members, have been reached so as to determine whether the surfaces of the components held by said selected one and said each other of said plurality of component holding members have been received within the recognizable range.

51. (Currently amended) ~~The component mounting apparatus according to claim 40;~~
~~further comprising:~~ A component mounting apparatus comprising:

a plurality of transversely movable component holding members;

~~a table in screw engagement with a ball screw, with said drive unit including a motor that is adapted to rotate said ball screw so as to vertically move said table;~~

~~cylinders fixed to said table, said cylinders corresponding to said component holding members; and being adapted~~

a recognition unit;

a drive unit including a motor that is adapted to rotate said ball screw so as to vertically move said table such that to bring a tip of a piston is brought into contact with a selected corresponding one of said component holding members so as to vertically move the selected corresponding one of said component holding members, from among the other of said component holding members, ~~and thereby~~

transmit vertical movement of said table to the selected corresponding one of said component holding members;

a head unit including said plurality of component holding members and said drive unit;

a first control unit for producing a velocity curve, for vertical movement of selected ones of said plurality of component holding members, with parameters of

(i) a target position in a height direction at a time when vertical movement of said selected ones of said plurality of component holding members is to be controlled by said motor so as to position the surfaces of the components held by said selected ones of said plurality of component holding members within the recognizable range,

(ii) a maximum velocity of said selected ones of said plurality of component holding members during vertical movement thereof to the target position, and

(iii) a maximum acceleration of said selected ones of said plurality of component holding members during vertical movement thereof to the target position; and

a second control unit for, on a basis of the velocity curve, and in response to a starting instruction upon arrival of said selected ones of said plurality of component holding members at a starting position due to said selected ones of said plurality of component holding members moving transversely toward said recognition unit, driving said motor so as to automatically start vertical movement of said selected ones of said plurality of component holding members so as to position the surfaces of the components held by said selected ones of said plurality of component holding members within said recognizable range,

wherein said recognition unit, said plurality of component holding members, said table, said drive unit, said head unit, said first control unit and said second control unit are constructed and arranged such that while said plurality of component holding members are transversely moved relative to said recognition unit, with said plurality of component holding members holding a plurality of components such that surfaces of the plurality of components are at different levels,

(i) for each surface of the plurality of components that does not correspond to a recognizable range of said recognition unit, a corresponding one of said plurality of component holding members is vertically moved by said drive unit so as to adjust the level of this surface such that this surface is brought within the recognizable range, and

(ii) when each surface of the plurality of components comes within the recognizable range, said recognition unit is used to recognize this surface,

so as to continuously recognize the surfaces of the plurality of components.

52. (Previously presented) The component mounting apparatus according to claim 51, further comprising:

a transverse movement motor for moving said plurality of component holding members in a transverse direction,

wherein said first control unit is also for producing a velocity curve, for transverse movement of said selected ones of said plurality of component holding members via said transverse movement motor, with parameters of

(i) a target position in the transverse direction at a time when transverse movement of said selected ones of said plurality of component holding members to vertical drive starting positions for said selected ones of said plurality of component holding members is to be controlled by said transverse movement motor so as to prepare to position the surfaces of the components held by said respective ones of said plurality of component holding members within the recognizable range,

(ii) a maximum velocity of said selected ones of said plurality of component holding members during transverse movement thereof to the target position, and

(iii) a maximum acceleration of said selected ones of said plurality of component holding members during transverse movement thereof to the target position; and

wherein said second control unit is also for, on a basis of the velocity curve for transverse movement and in response to a starting instruction, driving said transverse movement motor so as to move said selected ones of said plurality of component holding members to the starting position due to said selected ones of said plurality of component holding members moving with said head unit transversely toward said recognition unit.

Claims 53-60 (Cancelled)

61. (Currently amended) ~~The component mounting apparatus according to claim 43;~~
~~further comprising:~~ A component mounting apparatus comprising:

a first group and a second group of component holding members;

a table adapted to be moved vertically by said drive unit; and having cylinders fixed to thereto
said table, said cylinders corresponding to said component holding members; ;

a drive unit to vertically move said table wherein such that each of said cylinders is adapted
to bring capable of bringing a tip of a piston into contact with a selected corresponding one of said
component holding members so as to vertically move the selected corresponding one of said
component holding members, from among the other of said component holding members; and thereby
transmit vertical movement of said table to the selected corresponding one of said component holding
members;

a recognition unit;

a head unit including said component holding members and said drive unit; and

structure for acquiring information on said first group and said second group of component
holding members, wherein each component holding member of said first group is to hold a component
such that a surface of this component is within a recognizable range of said recognition unit when a
bottom end surface of said each component holding member of said first group is at a first level, and
wherein each component holding member of said second group is to hold a component such that a
surface of this component is not within the recognizable range of said recognition unit when a bottom
end surface of said each component holding member of said second group is at the first level,

wherein said table, said first and second groups of component holding members, said drive
unit, said recognition unit and said head unit are constructed and arranged such that

(i) while moving said each component holding member of said first group in a first
direction over said recognition unit such that said bottom end surface of said each component holding
member of said first group is at the first level, the surface of each component held by said each
component holding member of said first group is recognized by using said recognition unit to
recognize a shape of this component, and then

(ii) after using said drive unit to vertically move said table so as to vertically move said
each component holding member of said second group such that the surface of each component held

by said each component holding member of said second group is within the recognizable range of said recognition unit, and while moving said each component holding member of said second group in a second direction, opposite to the first direction, over said recognition unit, the surface of each component held by said each component holding member of said second group is recognized by using said recognition unit to recognize a shape of this component.

62. (New) A component mounting method comprising:

providing

- (i) a plurality of transversely movable component holding members,
- (ii) a table in screw engagement with a ball screw,
- (iii) cylinders fixed to said table, said cylinders corresponding to said component holding members,

- (iv) a recognition unit, and

- (v) a drive unit including a motor that is adapted to rotate said ball screw so as to vertically move said table such that a tip of a piston is brought into contact with a selected corresponding one of said component holding members so as to vertically move the selected corresponding one of said component holding members, from among the other of said component holding members;

using a first control unit to produce a velocity curve, for vertical movement of selected ones of said plurality of component holding members, with parameters of

- (i) a target position in a height direction at a time when vertical movement of said selected ones of said plurality of component holding members is to be controlled by said motor so as to position the surfaces of the components held by said selected ones of said plurality of component holding members within the recognizable range,

- (ii) a maximum velocity of said selected ones of said plurality of component holding members during vertical movement thereof to the target position, and

- (iii) a maximum acceleration of said selected ones of said plurality of component holding members during vertical movement thereof to the target position;

while said plurality of component holding members are transversely moved relative to said recognition unit, with said plurality of component holding members holding a plurality of components such that surfaces of the plurality of components are at different levels, using a second control unit to, on a basis of the velocity curve, and in response to a starting instruction upon arrival of said selected ones of said plurality of component holding members at a starting position due to said selected ones of said plurality of component holding members moving transversely toward said recognition unit, for each surface of said plurality of components that does not correspond to a recognizable range of said recognition unit, using said drive unit to vertically move said table so as to vertically move a corresponding one of said plurality of component holding members such that the level of this surface is adjusted whereby this surface is brought within said recognizable range; and

when each surface of said plurality of components comes within said recognizable range, using said recognition unit to recognize this surface,

so as to continuously recognize said surfaces of said plurality of components.